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In The
Supreme Court of the United States

COMMONWEALTH OF MASSACHUSETTS, et al.,

Petitioners,

v.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY, et al.,

Respondents.

On A Writ Of Certiorari To The United States Court Of Appeals For The District Of Columbia Circuit

BRIEF OF AMICI CURIAE WILDLIFE CONSERVATION INTERESTS IN SUPPORT OF PETITIONERS

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INTEREST OF AMICI CURIAE[1]

Amici organizations represent a substantial number of hunters, anglers, bird watchers, religious groups, zoos and aquariums, state wildlife agencies, professional societies of wildlife biologists and other wildlife conservationists.[2] Many amici, particularly the hunter, angler and bird watcher groups, rely on abundant wildlife and healthy ecosystems for recreation. Many amici, particularly the state wildlife agencies, professional societies and zoos and aquariums, have expertise in the scientific aspects of wildlife management, ecosystem conservation and the impacts of climate change on wildlife and ecosystems. Many amici, particularly the religious groups, have expertise in the ethical issues surrounding human-caused extinctions and other harmful effects of climate change. All amici depend on the services that healthy ecosystems provide, appreciate how the decline of wildlife and ecosystems harms the economy and quality of life in their communities and have a strong and demonstrated interest in conserving wildlife and ecosystems for future generations.

SUMMARY OF ARGUMENT

Climate change caused by greenhouse gas pollution is threatening the legacy of abundant wildlife and natural

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[1] Pursuant to S.Ct.R. 37.3(a) and 37.6, the undersigned represents that (1) all parties consented to the filing of this brief, (2) no counsel for any party authored this brief in whole or in part, and (3) no person or entity other than above-named amici curiae and their counsel made a monetary contribution to the preparation or submission of this brief.

[2] *See* Appendix (identifying amici organizations by category). The term "wildlife" is used here in its broadest sense to mean all wild animals and plants. *See The American Heritage Dictionary of the English Language* (4th ed. 2000). "Ecosystem" means a community of organisms, including wild animals and plants, interacting with one another and with the chemical and physical factors making up their environment. *See* G. Tyler Miller, Jr., *Environmental Science: Sustaining the Earth* A7 (1991).

beauty that Americans seek to bequeath to their children and grandchildren.[3] Abundant wildlife and healthy ecosystems are the foundation of our economy and the key to our quality of life. Billions of dollars of revenue are generated annually in the U.S. by hunting, angling and other wildlife-oriented recreation and by the numerous other industries, such as commercial fishing, pharmaceuticals and agriculture, that depend on wild animals and plants and healthy ecosystems. Natural habitats protect drinking water, provide food and medicine and buffer communities against floods and storms. Incalculable spiritual and aesthetic benefits are realized when families take time away from their busy lives to enjoy nature-based activities. Much of this is placed at risk due to the harmful effects of greenhouse gas pollution and resultant climate change on wildlife and ecosystems.

The Clean Air Act ("Act") requires the EPA to address this harm. Section 202(a)(1) of the Act states that if in the judgment of the EPA Administrator, "any air pollutant" from motor vehicles "cause[s] or contribute[s] to air pollution which may reasonably be anticipated to endanger public health or welfare," the EPA "shall" regulate that pollution. Under section 302(h), effects on "welfare" include effects on "climate" and "wildlife." Thus, the EPA has a duty to consider whether greenhouse gases may endanger the health and welfare of people by harming the climate and wildlife that people depend upon.

There is virtually no disagreement among scientists that greenhouse gas pollution harms climate and wildlife. The leading scientific societies from the United States and ten other nations have stated that the science on greenhouse gas pollution's effects on climate is now sufficiently clear to justify nations taking prompt action.

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[3] Greenhouse gases are air pollutants known to contribute to global climate change by trapping heat in the atmosphere. Thomas E. Lovejoy & Lee Hannah, *Climate Change and Biodiversity* 21 (2005).

The Intergovernmental Panel on Climate Change ("IPCC") has found that greenhouse gas pollution has already caused an increase of 1 degree Fahrenheit in average surface temperatures around the globe and that, unless such pollution is curtailed, average surface temperatures will increase between 2.5 to 10.4 degrees Fahrenheit in the coming century.

Scientific experts predict that such warming would devastate wildlife and ecosystems. Under mid-range climate warming scenarios, as many as one-third of species in some regions are likely to be committed to future extinction due to climate change over the next 50 years. Many treasured wildlife species in the U.S. are at serious risk, including waterfowl in the northern Great Plains, crabs and oysters in Apalachicola Bay, Florida, trout and salmon in the Pacific Northwest and polar bears in Alaska.

Effects of climate change on wildlife and ecosystems are already apparent. Even with the relatively low temperature increases experienced in the past century (in comparison with projected increases), wildlife species have already become extinct or have been extirpated from parts of their geographic range due to excessive temperatures. Sea level rise has accelerated, and hurricanes and typhoons have become more intense, harming coastal marshes that serve as nurseries for fish and provide buffers from storms. Sea ice has melted, leading to declines in at least one polar bear population. Snowpack on Western mountains has begun shrinking, creating dangerously low summer flows in salmon and trout streams. Pests have invaded forests, destroying millions of trees. Ocean waters have become warmer, contributing to a decline in coral reefs and increased disease in shellfish.

These and other harmful impacts of climate change on wildlife and ecosystems pose a serious threat to people. The United States is blessed with abundant natural resources. These resources have served as the backbone of many jobs and industries and have provided

food, medicines, flood protection and a host of other services. Wildlife species and ecosystems have also provided recreational opportunities and solace to millions of Americans. The EPA must act now to limit greenhouse gas pollution to conserve these precious resources for future generations.

ARGUMENT

I. EPA FAILED TO CONSIDER THE HARMFUL EFFECTS OF CLIMATE CHANGE ON WILDLIFE

Climate change caused by greenhouse gas pollution is one of the greatest threats to wildlife in the United States and around the globe.[4] Fortunately, the United States government has many tools with which to address greenhouse gas pollution and climate change. The Clean Air Act is one of the most important of these tools.

A. The Clean Air Act Explicitly Requires that EPA Consider Climate and Wildlife in Deciding Whether to Regulate Air Pollutants

Section 202(a)(1) of the Act states that if in the judgment of the EPA Administrator, "any air pollutant" from motor vehicles "cause[s] or contribute[s] to air pollution which may reasonably be anticipated to endanger public health or welfare," EPA "shall" regulate that pollution.[5] "Welfare" is defined by section 302(h) as including "effects on soils, water, crops, vegetation, manmade materials, animals, *wildlife,* weather, visibility *and climate*. . . ."[6]

Thus, under the Act, the EPA Administrator has both the authority and duty to set limits on air pollutants that

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[4] *See* Chris D. Thomas *et al., Extinction Risk from Climate Change*, 427 Nature 145, 147 (2004).

[5] 42 U.S.C. § 7521(a)(1).

[6] *Id.* § 7602(h) (emphasis added).

may endanger the climate or wildlife. In refusing to set limits on greenhouse gases, EPA violated its duty to consider the impacts of air pollutants on these critical elements of the natural environment.

B. EPA's Failure to Address Climate Change and its Impacts on Wildlife Cannot Be Justified on the Ground of Scientific Uncertainty

There is broad agreement among scientists – including those from the EPA itself – that climate change is already harming wildlife and ecosystems, that climate change will cause substantial additional harm in the future if not addressed and that a substantial reduction of greenhouse gas pollution is necessary to address this problem.[7] As each day passes without confronting this pollution, severe ecosystem disruption and widespread species extinction becomes more likely and more difficult and costly to forestall.

The leading scientific societies from the United States and ten other nations made this abundantly clear in a recently-issued joint statement:

> The scientific understanding of climate change is now sufficiently clear to justify nations taking prompt action. It is vital that all nations identify cost-effective steps that they can take now, to contribute to substantial and long-term reduction in net global greenhouse gas emissions.
>
> * * *

[7] *See infra* Part II.

> Failure to implement significant reductions in net greenhouse gas emissions now, will make the job much harder in the future.[8]

Ecosystem disruption and species extinction harms all people by damaging the economy and otherwise reducing quality of life.[9] Amici, whose members are heavily engaged in the enjoyment and conservation of wildlife and habitats, are directly injured by the inaction of the EPA. The Clean Air Act mandates immediate action to prevent further endangerment of their health and welfare.

II. CLIMATE CHANGE IS DISRUPTING THE ECOSYSTEMS THAT SUSTAIN WILDLIFE AND PEOPLE

There is virtually no dispute within the scientific community that greenhouse gas pollution from the burning of fossil fuels (coal, natural gas and oil) is causing, and will continue to cause, global climate change.[10] The average global temperature has risen more than 1 degree Fahrenheit during the past century, and the concentration of carbon dioxide in the atmosphere is now higher than at any time during the past 650,000 years.[11] According to the National Research Council, in a report requested by the Bush Administration, this human-induced warming and its associated sea level rise are expected to continue

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[8] *Joint Science Academies' Statement: Global Response to Climate Change* (June 7, 2005) at 1, *available at* http://www.royalsoc.ac.uk/displaypagedoc.asp?id=20742.

[9] *See infra* Part III.

[10] *See* Intergovernmental Panel on Climate Change, *Climate Change 2001: Synthesis Report* 4-5 (2001) [hereinafter IPCC, *Synthesis Report 2001*].

[11] Intergovernmental Panel on Climate Change, *Summary for Policymakers: A Report of Working Group I of the IPCC* at 2, 7 (2001) [hereinafter IPCC, *Summary for Policymakers*]; Edward J. Brook, *Atmospheric Science: Tiny Bubbles Tell All*, 310 Sci. 1285-87 (2005).

through the 21st century.[12] Without sufficient action to reduce greenhouse gas pollution, scientists estimate that the average surface temperatures across the globe will increase between 2.5 to 10.4 degrees Fahrenheit in the coming century.[13]

The overall consequences of such climate change for wildlife and people would be disastrous.[14] Under mid-range climate warming scenarios, as many as one-third of species in some regions are likely to be "committed to future extinction" due to climate change over the next 50 years.[15] Such a massive loss of biological diversity would wreak havoc on the ecosystems that people depend upon for their livelihoods and quality of life. The following are some of the most striking examples of climate change's harmful impacts on wildlife and people.

A. Wildlife Faces Increased Risks of Extinction Due to Rising Surface Temperatures

Every wildlife species has a particular set of temperature conditions in which it has evolved and which it relies upon for its survival. For many species, the increases in surface temperatures forecasted for the coming decades will make current habitats unsuitable.[16] Unless they are

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[12] National Research Council, *Climate Change Science: An Analysis of Some Key Questions* 1 (2001).

[13] IPCC, *Summary for Policymakers*, *supra*, at 13.

[14] Although some species will probably benefit from warming trends, many of these will be invasive and harmful to people and native wildlife. *See* Doug Inkley, The Wildlife Society, *Global Climate Change and Wildlife* 8 (2004).

[15] Thomas *et al.*, *Extinction Risk from Climate Change*, *supra*, at 147.

[16] Pew Ctr. on Global Climate Change, *A Synthesis of Potential Climate Change Impacts on the U.S.* iii, 14-15 (2004).

able to move into new and more suitable habitats, they will face the threat of extinction.[17]

Scientists have studied the effects of the past century's temperature increases on wildlife to obtain clues about the changes to be expected in the coming decades. This research shows that even relatively small temperature increases will disrupt ecosystems and the ecological communities of plants and animals within those ecosystems.[18]

One key scientific finding is that the geographic ranges of numerous wildlife species around the world are shifting, either toward the poles or up mountain slopes, in concert with regional warming trends.[19] Since the mid-20th century, wildlife has moved toward the poles an average of four miles per decade and upslope an average of 20 feet per decade.[20]

This geographic shift does not mean that the species are adapting to climate change. In fact, many species are projected to lose habitats at the edge of the range nearest to the equator, or at the lowest elevations, without gaining habitats at the edge of the range nearest to the poles or at

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[17] *Id.* at 14.

[18] *See* Camille Parmesan & Gary Yohe, *A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems*, 421 Nature 37, 42 (2003) (statistical review of historical observations of 1,700 species shows that climate change is causing a "clear pattern" of changes to species and is "an important driving force on natural systems") [hereinafter *A Globally Coherent Fingerprint*]; Terry L. Root *et al.*, *Fingerprints of Global Warming on Wild Animals and Plants*, 421 Nature 57-60 (2003) (meta-analysis of 143 studies reveals a "significant impact" of climate change on animal and plant populations); Gian-Reto Walther *et al.*, *Ecological Responses to Recent Climate Change*, 416 Nature, 389, 394 (2002) (review of extensive body of scientific studies shows that climate change is altering range, distribution and seasonal cycles of species and composition and dynamics of ecological communities).

[19] *A Globally Coherent Fingerprint, supra*, at 37.

[20] *Id.*

higher elevations.[21] This habitat loss increases the likelihood of extinction.

Among the reasons why many species will not be able to shift to new habitats in response to intolerable temperature conditions is because key resources (*e.g.*, food supply, appropriate soils) are not available there.[22] For example, scientists project that the prairie pothole region of the northern Great Plains, the most important breeding area for ducks in North America, will lose many of its unique wetlands if warming trends continue.[23] As suitable wetlands become unavailable, ducks may be displaced northward. However, wetlands to the north hold less water in the spring, and thus ducks moving there will have significantly reduced breeding potential.[24] The decline of ducks from the prairie pothole region would seriously harm hunters and bird watchers and the many businesses that serve these large numbers of wildlife enthusiasts.

Another reason many species will not be able to shift into new habitats is because of natural obstacles to

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[21] *See* Terry L. Root & Stephen H. Schneider, *Climate Change: Overview and Implications for Wildlife* 5-6 *in Wildlife Responses to Climate Change: North American Case Studies* (Stephen H. Schneider & Terry L. Root eds. 2002); Walther *et al.*, *Ecological Responses to Recent Climate Change*, *supra*, at 394.

[22] *See* Root *et al.*, *Fingerprints of Global Warming on Wild Animals and Plants*, *supra*, at 59. Similarly, species may not be able to shift because other species with which they are interconnected may fail to move in tandem, *id.*, and invasive species may limit their ability to persist in their new habitats. Thomas *et al.*, *Extinction Risk from Climate Change*, *supra*, at 147; Habiba Gitay *et al.*, Intergovernmental Panel on Climate Change, *Climate Change and Biodiversity*, *IPCC Technical Paper V* 32 (2002) [Hereinafter Gitay, *IPCC Technical Paper V*].

[23] W. Carter Johnson *et al.*, *Vulnerability of Northern Prairie Wetlands to Climate Change*, 55 BioSci. 863, 871 (2005).

[24] *See* Lisa G. Sorensen *et al.*, *Potential Effects of Global Warming on Water Fowl Populations Breeding in the Northern Great Plains*, 40 Climatic Change 343-69 (1998).

movement, such as large water bodies (which create barriers for terrestrial species) and coastlines (for marine and estuarine species).[25] A study of potential effects of increased warming in Apalachicola Bay, Florida, showed that important fishery species, including crabs, shrimp, oysters and flounder, might not be able to survive past this century due to their inability to move into more tolerable temperature conditions.[26] Apalachicola Bay has one of the largest commercial oyster fisheries in the world, and it is also renowned for saltwater recreational fishing. Increased water temperatures, combined with sea level rise, put this irreplaceable resource in jeopardy. In this way, climate change directly harms commercial fishermen, recreational fishermen, seafood lovers, tourists and the many businesses that serve these people.

The "most threatening aspect of climate change for biodiversity" is the role of habitat fragmentation in blocking wildlife movement.[27] As temperatures increase in current habitats, nearby highways, cities, subdivisions, farms and other kinds of human activity will greatly limit the ability of wildlife to move to habitats with more suitable temperature conditions.[28]

The Edith's checkerspot butterfly is an example of a species that is disappearing from parts of its range and edging closer to extinction due to the combined effects of climate change and habitat fragmentation. Three subspecies of this butterfly are already endangered due to habitat

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[25] *See* Camille Parmesan, *Biotic Response: Range and Abundance Changes*, *in* Lovejoy & Hannah, *supra*, at 52.

[26] Robert J. Livingston, *Projected Changes in Estuarine Conditions Based on Models of Long-Term Atmospheric Alteration*, *in* U.S. EPA, *The Potential Effects of Global Climate Change on the United States: Report to Congress* 339-40 (Joel B. Smith & Dennis Tirpak eds. 1989).

[27] Lee Hannah *et al.*, *Biodiversity and Climate Change in Context*, *in* Lovejoy & Hannah, *supra*, at 4.

[28] Walther *et al.*, *Ecological Responses to Recent Climate Change*, *supra*, at 394.

fragmentation.[29] Because increased temperatures are drying up the butterfly's host plant and because the butterfly cannot disperse to the north (it is blocked by human development), 80 percent of historical populations in the southern end of the species' range in California and Mexico have recently disappeared.[30]

With these extirpations, the Edith checkerspot butterfly's range has shifted northward by 55 miles and upward in elevation by 409 feet. Unfortunately, these losses have not been accompanied by gains in other parts of the species' range, where extirpations are also occurring, albeit at a slower pace.[31] For the Edith's checkerspot butterfly, a geographic shift does not mean that the species is adapting to climate change; it simply means that population declines have accelerated in parts of the species' range.[32]

Increased surface temperatures around the world are also causing alterations in the timing of seasonal activities of wildlife.[33] As with geographic shifts, these alterations appear across numerous taxonomic groups and geographic regions. Examples of spring events with altered timing include earlier breeding of birds, earlier arrivals of migrant birds in the spring, earlier appearance of butterflies, earlier breeding choruses and spawning in amphibians and earlier sprouting and flowering of plants.[34]

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[29] Camille Parmesan & Hector Galbraith, Pew Ctr. on Global Climate Change, *Observed Impacts of Global Climate Change in the U.S.* 24 (2004).

[30] *Id.*

[31] *Id.*

[32] *Id.*

[33] Terry L. Root & Lee Hughes, *Present and Future Phenological Changes in Wild Plants and Animals*, *in* Lovejoy & Hannah, *supra*, at 61-69.

[34] *Id.* at 63; *see also A Globally Coherent Fingerprint*, *supra*, at 38.

Over the course of the past half-century, the timing of these spring events has changed dramatically. In a meta-analysis of 64 studies, researchers found that in each of the last five decades, spring events in temperate zones took place an average of five days earlier than the decade before it.[35] The only explanation for these disturbing phenomena was climate change.[36]

Shifts in seasonal activities are problematic because species that normally interact with each other do not necessarily shift in unison.[37] When the seasonal activities of normally interacting species are out of synch, ecological communities can be torn apart, leading to numerous extirpations and extinctions.[38]

For example, the caterpillars of the winter moth, which rely solely on young oak leaves for food, now hatch earlier due to warming trends.[39] Unfortunately, the date on which oaks bear their first leaves has not changed significantly, so the caterpillars are now in decline due to lack of food.[40] A caterpillar's loss of food supply immediately affects the food web because, with far fewer caterpillars, birds have less prey.[41] This loss of prey could lead to the decline and extinction of one or more species of birds.

Once a species becomes extinct, it is gone forever. Such an irreversible loss reverberates throughout the

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[35] Root *et al.*, *Fingerprints of Global Warming on Wild Animals and Plants*, *supra*, at 59.

[36] *Id.*

[37] Root & Hughes, *Present and Future Phenological Changes in Wild Plants and Animals*, *in* Lovejoy & Hannah, *supra*, at 64.

[38] Tim Flannery, *The Weather Makers* 89 (2005).

[39] Marcel E. Visser & Leonard Holleman, *Warmer Springs Disrupt the Synchrony of Oak and Winter Moth Phrenology*, Proceedings of the Royal Society B. 268, 289-94 (2001).

[40] *Id.*

[41] *Id.*; *see also* Flannery, *supra*, at 89-90.

ecosystem and ultimately harms people. For example, a bird's extinction means the disappearance of key services that birds typically provide, such as pollination of plants, dispersal of seeds, and control of insects.[42] These are services that farmers, nurseries, gardeners and many others depend upon for their livelihoods and quality of life.

The best chance for preventing or minimizing such losses is to take prompt action to limit the greenhouse gas pollution that is causing the increased surface temperatures and resultant disruptions of wildlife and ecosystems.

B. Rising Sea Levels and Intensified Hurricanes and Typhoons Jeopardize Coastal Wildlife and Ecosystems

The aspect of climate change that poses the most dramatic threat to people and wildlife is the rapid melting of glaciers and the polar ice fields of Antarctica and Greenland.[43] Accompanying this melting is the thermal expansion of the oceans, also caused by increased surface temperatures (warmer water occupies more space). Together these phenomena are causing an accelerated rise in sea levels.[44] Average global sea levels rose 4 to 8 inches over the 20th century, and the IPCC projects an additional rise of 4 to 35 inches by 2100.[45] Recent scientific discoveries

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[42] *Id.*

[43] *See* World View of Global Warming, *Glaciers and Glacial Warming: Receding Glaciers* (2006), http://www.worldviewofglobalwarming.org/pages/glaciers.html) (see photos and discussion of Greenland Glacier); NASA, *Arctic Sea Ice Continues to Decline, Arctic Temperatures Continue to Rise in 2005* (Sept. 28, 2005), http://www.nasa.gov/centers/goddard/news/topstory/2005/arcticice_decline.html) (showing declines in Arctic ice fields with images of sea ice minimums in 1979 and 2005).

[44] IPCC, *Synthesis Report 2001, supra,* at 6.

[45] *Id.*

concerning the rapid melting of polar ice fields suggest that this estimate may be too conservative.[46]

Sea level rise is among the most costly and certain consequences of greenhouse gas pollution.[47] In addition to endangering people and destroying property, it places low-lying coastal ecosystems, and the wildlife that inhabits them, in considerable jeopardy.[48] These vulnerable ecosystems support commercial and recreational fishing and tourism and provide incalculable aesthetic benefits.[49]

Rising seawater harms coastal ecosystems in a variety of ways. Salt marshes and other shallow habitats adapted to saltwater environments are overwhelmed by the increasing depth of the water and the loss of sunlight, oxygen and nutrient flows.[50] Seawater is toxic to brackish water species, and brackish water is toxic to freshwater species. Rising sea levels will disturb the delicate balance between aquatic species and the sunlight, oxygen, nutrients and salinity in their habitats, especially in areas where ecosystems are unable to migrate inland because of human development.[51] Sea level rise *alone* is projected to destroy 20 percent of coastal wetlands around the globe by 2080.[52]

This destruction of coastal wetlands will likely have devastating effects on commercial and recreational fishing around the world. For example, along Florida's gradually-sloped shores, a 15 inch rise in sea level would cause water to advance inland by about 250 feet, eroding coastal

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[46] *See* Flannary, *supra*, at 146-50; Julian A. Dowdeswell, *The Greenland Ice Sheet and Global Sea-Level Rise*, 311 Sci. 963-64 (2006).

[47] *See* Inkley *et al.*, *supra*, at 7.

[48] *Id.*

[49] *See infra* Part III.

[50] Sam H. Pearsall, *Managing for Future Change on the Albermarle Sound*, *in* Lovejoy & Hannah, *supra*, at 359.

[51] *See id.*

[52] Gitay, *IPCC Technical Paper V*, *supra*, at 1.

shorelines and inundating and altering wetlands, saltmarshes and other habitats. In fact, nearly 50 percent of critical saltmarsh and 84 percent of tidal flats could be lost. Because Florida's marine fish and shellfish species depend on saltmarshes, seagrass beds and other bay and estuary habitats, the projected sea level rise could devastate Florida's commercial and recreational fisheries.[53]

Exacerbating the problem of sea level rise is the increased intensity of hurricanes and typhoons. During the past few decades of steadily increasing surface temperatures, the number of category 4 and 5 hurricanes and typhoons recorded around the globe has almost doubled, and the total amount of energy released by hurricanes and typhoons has increased by 60 percent.[54] The combined effects of sea level rise and storm surges from hurricanes and typhoons is expected to wreak havoc on low-lying coastal habitats and could even result in saltwater intrusion into freshwater aquifers, which supply drinking water for many communities.[55]

The climate change impacts of sea level rise and storm surges will worsen the damage already being caused by a host of non-climate-related human activities. For example, groundwater withdrawal, levee construction and dredging projects in river systems have reduced sediment accumulation in river deltas, leading to flooding and loss of land.[56] Sea level rise and storm surges fueled by climate change make flooding worse and greatly increase land loss.

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[53] National Wildlife Fed'n *et al.*, *An Unfavorable Tide: Global Warming, Coastal Habitats and Sportfishing in Florida* 4, 6 (2006).

[54] P.J. Webster *et al.*, *Changes in Tropical Cyclone Number, Duration and Intensity in a Warming Environment*, 309 Sci. 1844 (2005); Kerry Emanuel, *Increasing Destructiveness of Tropical Cyclones Over the Past 30 Years*, 436 Nature 686 (2005).

[55] Gitay, *IPCC Technical Paper V*, *supra*, at 20.

[56] *Id.*

This is exactly what has occurred in the Mississippi River delta, where alterations of the Mississippi River combined with sea level rise to convert nearly one million acres of coastal marshes to open water in the latter half of the 20th century.[57] These losses worsened dramatically when Hurricane Katrina roared through the Mississippi delta in 2005, destroying what once was a 40-mile-long set of barrier islands.[58]

By destroying coastal marshes, sea level rise and intensified hurricanes and typhoons threaten time-honored recreational activities such as waterfowl hunting and wildlife viewing. Waterfowl species threatened by destruction of coastal marshes include redheads, lesser scaup and canvasbacks.[59]

C. Disappearing Permafrost, Sea Ice and Snow Jeopardize Wildlife and Ecosystems

Any discussion of disappearing snow and ice must begin with the Arctic region, which is among the fastest-warming regions on the planet. The average annual temperature in the Arctic has risen at nearly twice the rate as the rest of the world, with the greatest increase occurring in winter months.[60] As a result, permafrost is thawing, with tundra habitat rapidly disappearing and giving way to lakes, wetlands, trees and shrubs.[61] Some of these areas are expected to ultimately turn into cold

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[57] Virginia Burkett & Jon Kusler, *Climate Change: Potential Impacts and Interactions in Wetlands of the United States*, 36 J. of the Am. Water Res. Ass'n 313-20 (2000).

[58] *See* Flannery, *supra*, at 313; *see also infra* Part II.G.

[59] U.S. Fish & Wildlife Serv., *North American Waterfowl Management Plan, Gulf Coast Joint Venture: Texas Mid-Coast Initiative* (2002).

[60] Susan Joy Hassol *et al.*, Arctic Climate Impact Assessment, *Impacts of a Warming Arctic* 19, 22 (2004).

[61] *Id.* at 48.

deserts because soil types are not suitable for holding water on the land.[62]

The tundra has served as major breeding and nesting grounds for a variety of migratory waterfowl as well as habitat for species, such as caribou, important to indigenous people's diets.[63] With the loss of tundra habitat, wildlife enthusiasts in the continental U.S. and indigenous people in the Arctic all suffer.[64]

Sea ice also is rapidly disappearing from the Arctic. In the past three decades, sea ice thickness in the late summer and early autumn has decreased by 40 percent.[65] If this melting continues as projected, it will have dire consequences for Arctic wildlife and the indigenous people who rely upon this wildlife for their survival. An early sign of the possible future is found in James and Hudson Bays in Canada, where polar bears suffered 15 percent declines in average weight and in number of cubs born in a recent 15-year period.[66] Because polar bears are dependent on sea ice for hunting, and because periods without sea ice have increased, these bears are going longer without feeding, and as a result suffering declines in reproduction and overall health. Polar bears are "unlikely" to survive the end of this century if, as some climate models predict, summer sea-ice cover completely disappears from their habitats.[67] The prospects for a number of other Arctic species, such as the walrus, ivory gulls, little auks and

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[62] *Id.* at 49.

[63] Gitay, *IPCC Technical Paper V*, *supra*, at 32.

[64] In addition to serving as important wildlife habitat, tundra is also a significant carbon reservoir. When permafrost thaws, this carbon is released to the atmosphere and climate change accelerates further. Sergey A. Zimov *et al.*, *Permafrost and the Global Carbon Budget*, 312 Sci. 1613 (2006).

[65] Gitay, *IPCC Technical Paper V*, *supra*, at 29.

[66] Hassol *et al. supra*, at 58.

[67] *Id.*

several species of seals, are equally bleak if the sea ice continues to melt as forecasted under current warming trends.[68] Thus, the recent decline of the polar bear could mark the beginning of the collapse of the entire Arctic ecosystem.[69]

Disappearance of snow could have even more far-reaching effects than disappearance of sea ice. On average, snow cover has decreased by 10 percent in the Northern Hemisphere in the past four decades.[70] There has also been a widespread retreat of glaciers across the globe.[71] In the western United States and many other places, snow provides the primary means of storage of winter precipitation, effectively transferring water from the relatively wet winters to the typically dry summers.[72] Since the middle of last century, much of the West has experienced declines in spring snowpack, despite increases in winter precipitation in many places. Earlier spring peak flows and lower summer flows have become increasingly common.[73]

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[68] *Id.* at 58-59.

[69] *See* Flannery, *supra*, at 102.

[70] Gitay, *IPCC Technical Paper V*, *supra*, at 6.

[71] *Id. See also World View of Global Warming* (2006), http://www.worldviewofglobalwarming.org/pages/glaciers.html (see photos and discussion of numerous glaciers); U.S. Geological Serv., *Repeat Photography Project, Glacier National Park, MT, available at* http://nrmsc.usgs.gov/repeatphoto/download_info.htm (website last modified Mar. 15, 2006) (showing side-by-side photographs taken over the last century of numerous glaciers in Glacier National Park); NASA, *Visible Earth, A Catalog of NASA Images and Animations of Our Home Planet, available at* http://visibleearth.nasa.gov/view_rec.php?id=1586 (database updated June 8, 2006) (showing image of the Larsen Ice Shelf in Antarctica and explaining that it is splintering as a result of warmer temperatures).

[72] *Impacts of Climate Change: Hearing Before the Senate Comm. on Commerce, Sci. & Transp.*, 108th Cong. (2004) (testimony of Dr. Phillip W. Mote).

[73] *Id.*

For the many people whose lives are tied to the health of the nation's trout and salmon-bearing rivers and streams, these changes are worrisome. Many rivers and streams already have unnaturally high temperatures and low flows due to activities such as dam-building, riparian land conversion and irrigation.[74] Earlier spring peak flows and lower summer flows exacerbate these problems by, among other things, making it more difficult for adult fish to navigate upstream to spawn.[75] In addition, lower-than-normal flows in the summer reduce the number of cool, deep water pools that fish need to survive excessive heat.[76] If reduced summer flows and other factors significantly increase average summer water temperatures as forecasted, this could render uninhabitable much of the remaining stream habitat of the nation's trout and salmon species.[77]

A wide variety of habitats, ranging from the polar bear's sea ice hunting grounds to the rivers and streams inhabited by trout and salmon, are at great risk due to global climate change and the resulting melting of ice and snow. The disappearance of polar bears, caribou, wild trout and salmon, and other ice- or snow-dependent flora and fauna will seriously harm the indigenous people of Alaska,

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[74] *See, e.g.*, James Kardouni & Nicoleta Cristea, *Quality Assurance Project Plan. Snoqualmie River Temperature Total Maximum Daily Load*, Wash. Dep't of Ecology, Pub. No. 06-03-106 (July 2006) at 12-13 (spawning area for threatened fall Chinook salmon is listed as impaired under Clean Water Act § 303(d) due to excessive temperature).

[75] Brian C. Spence *et al.*, ManTech Env. Research Serv., *An Ecosystem Approach to Salmonid Conservation*, TR-4501-96-6057 (1996).

[76] Joseph Ebersole *et al.*, *Thermal Heterogeneity, Stream Channel Morphology and Salmonid Abundance in Northeast Oregon Streams*, 60 Can. J. of Fisheries & Aquatic Sci. 1266-80 (2003).

[77] *See* Kirkman O'Neal, Defenders of Wildlife & Natural Res. Def. Council, *Effects of Global Warming on Trout and Salmon in U.S. Streams* (2002); Pew Ctr. on Global Climate Change, *Aquatic Ecosystems and Global Climate Change* 7-9 (2002).

the commercial and recreational fishermen of the continental U.S., and the many other people who rely upon these resources for their livelihoods and quality of life.

D. Invasive Species, Pathogens and Pests Are an Increasing Threat to Wildlife Due to Climate Change

Invasive species, pathogens and pests are all projected to increase as greenhouse gas pollution increases and associated warming trends continue, and each is expected to increase the vulnerability of native wildlife and ecosystems.[78] Invasive species are projected to become increasingly prevalent through two pathways: colonization of vegetation communities that have suffered dieback as a result of new temperature and precipitation conditions, and poleward and upslope expansion.[79] An example of an invasive species using the latter approach to benefit from climate change is the Chinese tallow, a freeze-intolerant tree species which is rapidly expanding in the Gulf Coast states and which can be expected to move northward as freeze-free zones expand.[80]

Similarly, tropical and subtropical diseases are projected to move poleward or upslope as higher latitude and higher elevation habitats become increasingly warm and moist.[81] For example, mosquito-borne diseases have expanded in recent decades in concert with the steady rise

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[78] *See* Inkley *et al.*, *supra*, at 8; Gitay, *IPCC Technical Paper V*, *supra*, at 32.

[79] Erika Zavaleta & Jennifer L. Royval, *Climate Change and the Susceptibility of U.S. Ecosystems to Biological Invasions: Two Cases of Expected Range Expansion in Wildlife Responses to Climate Change* 277 (Stephen H. Schneider & Terry L. Root eds. 2002).

[80] Inkley *et al.*, *supra*, at 8.

[81] *See id.* at 9.

in annual temperatures in the highlands of Asia, East Africa and Latin America.[82]

Warmer temperatures also are a significant factor in the growing incidence, range and severity of marine and estuarine diseases. When water temperatures exceed an optimal threshold, some marine and estuarine species become stressed and more susceptible to disease.[83] For example, as a result of warmer conditions in the Gulf of Mexico and along the east coast of the United States, the Eastern oyster has suffered an increased prevalence and intensity of diseases.[84] Economic impacts include reduced shellfish harvests and recreational fishing and declining sales in the tourism, fishing and restaurant trade.[85]

Climate-change-related disease also is playing a role in the wave of amphibian extinctions now taking place around the globe. Up to 22 of the world's amphibian species have become extinct since just 1980 and roughly one-third are currently threatened with extinction. One of the leading threats, a disease known as chytridiomycosis, is linked directly to climate change because warming creates the conditions ideal for its persistence and spread.[86] Amphibians have great potential for assisting researchers in the fields of biotechnology and medicine. If not addressed, climate change would not only potentially drive many amphibian species to extinction, but also

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[82] Walther *et al.*, *Ecological Responses to Recent Climate Change*, *supra*, at 391.

[83] C.D. Harvell *et al.*, *Emerging Marine Diseases – Climate Links and Anthropogenic Factors*, 285 Sci. 1507 (1999).

[84] P.R. Epstein, Center for Health & the Global Envt., Harvard Med. Sch., *Marine Ecosystems: Emerging Diseases as Indicators of Change* (1998).

[85] Center for Health and the Global Envt., Harvard Med. Sch., *Climate Change Futures Health, Ecological and Economic Dimensions* 83 (2005) [hereinafter *Climate Change Futures*].

[86] Joseph R. Mendelson III *et al.*, *Confronting Amphibian Declines and Extinctions*, 313 Sci. 48 (2006).

reduce researchers' chances of finding cures for cancer and other human diseases.

An increased frequency of pest outbreaks, especially in forest ecosystems, is also linked to climate change.[87] For example, in some high elevation areas in the southwestern United States, more than 90 percent of the piñon pine forest has died due to infestations of the bark beetle. Recent drought conditions, corresponding with regional warming trends, have made the trees much more susceptible to such infestations. If warming trends in the Southwest continue as projected, such forest die-offs will be more severe and extensive in the future.[88]

Climate-change-related pest infestations threaten to impose losses on a wide range of industries, including tourism (due to reduced scenic quality and recreational opportunities), food (due to loss of citrus and maple trees), and real estate development (due to increased vulnerability of forests to fires, erosion and landslides).[89]

E. Changes in Precipitation and Humidity Threaten Wildlife and Ecosystems

Climate change has led to severe reductions in precipitation and humidity in a number of regions around the world. For example, the western U.S. is now drier than at any other time in 700 years. Increased temperatures in the Pacific Ocean have shifted the jet stream (a wind current that affects snow and rain in North America) northward, leaving much of the western U.S. in severe drought.[90] These conditions pose a severe risk to wildlife

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[87] Gitay, *IPCC Technical Paper V*, *supra*, at 32.

[88] David D. Breshears *et al.*, *Regional Vegetation Die-off in Response to Global-Change-Type Drought*, 102 Proceedings of the Nat'l Academy of Sciences (Oct. 18, 2005), at 15144-48.

[89] *Id.*

[90] *See* Flannery, *supra*, at 132. Some experts believe that climate change is having a permanent impact on the El Niño-La Niña cycle of

(Continued on following page)

and ecosystems, especially due to fire. In the 1987-2003 time period, Western forests experienced a four-fold increase in numbers of large fires, and a seven-fold increase in federal land acres burned, compared to the previous 17-year period.[91] Although some fire is beneficial to the forest ecosystems of the western U.S., larger, more intense and more frequent wildfires caused by severe drought conditions threaten nearby homesteads, destroy old-growth forests, cause erosion and pose a host of other problems for endangered wildlife.[92]

Increased ocean temperatures have also caused drying of tropical rainforests. The "first documented victim of global warming," the golden toad, was driven extinct in the 1980s by the decline of moisture in its Costa Rican rainforest habitat, which was in turn caused by the abrupt rise in sea surface temperatures in the central western Pacific.[93] The golden toad evolved in a specific habitat niche with a specific level of humidity. Once that humidity disappeared, the species was doomed.

F. Increased Water Temperatures and Acidification Jeopardize Ocean Wildlife and Ecosystems

There is strong evidence that two features of greenhouse gas pollution – warmer temperatures and acidification (caused by absorption of carbon dioxide into water) – are harming ocean wildlife and ecosystems.

One of the most visible effects of warming of ocean waters is bleaching of coral reefs. Coral reefs have

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climate events that, among other things, determines the position of the jet stream. *Id.* at 84.

[91] A.L. Westerling *et al.*, *Warming and Earlier Spring Increases Western U.S. Forest Wildfire Activity*, 313 Sci. 940, 941 (2006).

[92] *See* Donald McKenzie *et al.*, *Climate Change, Wildfire, and Conservation*, 18 Conservation Biology 890 (2004).

[93] Flannery, *supra*, at 118.

sometimes been referred to as the "rain forests of the ocean" due to their diversity of life forms and spectacular beauty.[94] Bleaching occurs when the algae which lives symbiotically with the coral has died. Although coral can sometimes recover from bleaching, repeated and lengthy bleaching events with subsequent coral die-offs have occurred around the world in recent decades, and scientists have pinpointed the cause: ocean warming and intense El Niño events.[95] Scientists project that a majority of coral reefs around the world are likely to face extensive coral bleaching within the next 20 to 40 years if climate change continues unabated.[96]

Rising ocean temperatures are also causing significant changes in the marine food web in many regions. Plankton, organisms that form the base of the marine food web, rely upon nutrient-rich waters from the ocean depths as their primary food source. However, since 1977, warm water events have become increasingly frequent along the Pacific coast of the United States and, as a result, upwelling of deep, nutrient-rich waters has decreased. This has caused plankton to decline and has put virtually every marine species at risk, from the fish and invertebrates that eat the plankton to the seabirds and mammals that eat the fish. In less than 30 years, zooplankton in the region has declined 70 percent, fish larvae 50 percent and

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[94] Marjorie L. Reaka-Kudla, *The Global Biodiversity of Coral Reefs: A Comparison with Rain Forests, in Biodiversity II: Understanding and Protecting Our Biological Resources*, Chapter 7 (Marjorie L. Reaka-Kudla et al., eds., 1997).

[95] R.W. Buddemeier *et al.*, Pew Ctr. on Global Climate Change, *Coral Reefs & Global Climate Change: Potential Contributions of Climate Change to Stresses on Coral Reef Ecosystems* 15 (2004). *See also* note 90.

[96] Simon D. Donner *et al.*, *Global Assessment of Coral Bleaching and Required Rates of Adaptation Under Climate Change*, 11 Global Change Biology 2251 (2005).

seabirds 30 percent.[97] If current trends in ocean warming continue, the vast commercial fishing industry could suffer extensive losses, jeopardizing the regional economy and a significant part of the nation's food supply.

Rising atmospheric concentrations of carbon dioxide are also increasing the acidity of the world's oceans. As a result of the increased acidity, numerous marine organisms are less able to absorb key minerals, such as calcium, that make up their skeletal structures.[98] This poses serious risks to many of the ocean's ecological systems. For example, acidification could lead to the collapse of coral reef ecosystems, which would have devastating impacts on people and businesses in south Florida, the Caribbean and other tropical regions.

III. CONSERVING ABUNDANT WILDLIFE AND HEALTHY ECOSYSTEMS IS ESSENTIAL TO THE NATION'S ECONOMY AND QUALITY OF LIFE

A. Hunting, Fishing and Other Wildlife-Oriented Activities Help Fuel a Large Part of the Economy

The EPA's refusal to limit greenhouse gas pollution under the Clean Air Act has enormous detrimental consequences for people in the United States and around the world. As discussed *supra,* those who hunt, fish and otherwise enjoy wildlife-oriented recreation, and the many

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[97] John A. McGowan *et al.*, *The Biological Response to the 1977 Regime Shift in the California Current*, 50 Deep-Sea Research II 2567-82 (2003). Zooplankton, tiny ocean animals that drift along with ocean currents, are among the several types of plankton.

[98] Joan A. Kleypas *et al.*, NSF, NOAA & USGS, *Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers: A Guide for Future Research*, Report of a Workshop on April 18-20, 2005, Sponsored by NSF, NOAA & USGS 1 (2006).

businesses that serve them, are directly and immediately affected.

A recent study by the Outdoor Industry Foundation shows what a crucial role these individuals and businesses play in the U.S. economy. According to the study, active outdoor recreation, which includes camping, fishing, hunting, paddling, hiking and wildlife viewing, contributes a total of $730 billion annually to the U.S. economy, supports 6.5 million jobs (1 in 20 U.S. jobs), generates $88 billion in federal and state tax revenue and stimulates 8 percent of all consumer spending.[99]

To date, no one has estimated what percentage of this economic activity would be lost under various climate change scenarios. However, studies focusing on parts of the puzzle show that losses will be dramatic if greenhouse gas pollution is not significantly reduced. For example, the EPA's own experts estimate that the potential economic losses in cold-water recreational fishing in the U.S. due to climate change will be $1.3 to $3 billion per year.[100]

Losses of wildlife-oriented recreational opportunities are typically intertwined with a host of other economic losses projected to flow from climate change. For example,

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[99] Outdoor Industry Found., *The Active Outdoor Recreation Economy* (2006). The study also includes within its definition of active outdoor recreation snow sports and bicycling, which arguably are not directly dependent on abundant wildlife and healthy ecosystems. If these activities are removed from the study's statistics, the impact of wildlife-oriented recreation would still be quite sizable: $531 billion annually added to the economy, supporting 4.8 million jobs, and generating $61 billion in federal and state tax revenue. *Id.* at 19. *See also* U.S. Fish & Wildlife Serv., *National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (2001) (more than 82 million U.S. residents fished, hunted, or viewed wildlife in 2001; spending on these three activities totaled $108 billion).

[100] Susan Herrod Julius, U.S. EPA Global Change Research Program, *What Are the Potential Impacts of Climate Change on Fresh Water Recreational Fishing Opportunities in the U.S.?* Presentation to the Water Ecology and Climate Change Workshop (June 15, 2001).

as noted *supra*, climate change is projected to have devastating impacts on coral reefs around the world. Healthy reef ecosystems support a commercial and recreational fishing industry worth billions of dollars, and some developing countries rely on reef fisheries for virtually all of their animal protein consumption. Reefs protect coasts by reducing storm damage and erosion due to intense wave action, and many regions depend on reefs for their tourism industries. Studies in the Indian Ocean region show that a single catastrophic episode of coral reef bleaching would cost up to $18 billion to the region's economy.[101]

Losses would likely be much larger for communities and businesses dependent on the reefs in south Florida and the Caribbean, where coastal development and tourism is much more extensive. For example, the total value of reef-related shoreline protective services in the Caribbean region alone has been estimated to be between $740 million and $2.2 billion per year,[102] and the reefs of the Florida Keys alone generated $4.4 billion in tourism revenues in 2000-01. Climate change has placed this wildlife treasure and economic engine in serious jeopardy.[103]

B. Healthy Ecosystems Provide Services that Sustain the Economy

Conserving wildlife and ecosystems has many economic benefits to people beyond those that are quantified in the marketplace. Ecosystems perform fundamental life-support services without which human civilizations would

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[101] *Climate Change Futures*, *supra*, at 81.

[102] *Id.* at 77.

[103] Daniel Scott *et al.*, *Climate Change and Tourism and Recreation in North America: Exploring Regional Risks and Opportunities*, *in Tourism, Recreation and Climate Change* 126 (C. M. Hall & J. Higham eds., 2005).

cease to thrive.[104] These include the purification of air and water, detoxification and decomposition of wastes, regulation of climate, regeneration of soil fertility and production and maintenance of biodiversity.[105]

Agricultural, pharmaceutical, commercial fishing and numerous other industries that harvest natural resources sectors depend on healthy ecosystems. For these industries, which represent large portions of the economy, there is significant potential for disruption of current harvesting practices and livelihoods under climate change scenarios.[106]

Fish is the leading source of animal protein for the world's population, with the annual catch valued between $50 billion and $100 billion.[107] Significant harvest reductions in the commercial fishing industry (valued at $8.2 billion in 1990) would have enormous consequences. Likewise, if climate change were to force substantial reductions in recreational fishing, this too would harm many people and businesses. The value of freshwater sport fishing in the U.S. alone greatly exceeds that of the global commercial harvest, with direct expenditures in 1991

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[104] Gretchen C. Daily *et al., Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems*, 2 Issues in Ecology 1 (1997).

[105] An extensive body of literature has evolved around the measurement of the value of such "ecosystem services." *See, e.g.*, James Boyd & Spencer Banzhaf, Resources for the Future, *What Are Ecosystem Services? The Need for Standardized Environmental Accounting Units* (2006); James Salzman, *Creating Markets for Ecosystem Services: Notes from the Field*, 80 N.Y.U. L. Rev. 870, 871-72 (2005); Gretchen C. Daily, *Introduction: What Are Ecosystem Services?, in Nature's Services: Societal Dependence on Natural Ecosystems* 1, 3-4 (Gretchen C. Daily ed., 1997).

[106] Jay R. Malcolm & Louis F. Pitelka, Pew Ctr. on Global Climate Change, *Ecosystems & Global Climate Change: A Review of the Potential Impacts on U.S. Terrestrial Ecosystems and Biodiversity* 29 (2000).

[107] Daily *et al., supra*, at 4.

totaling roughly $16 billion. Once the value of sport fishing-related jobs is added in, the total increases to $46 billion.[108]

A significant reduction in the ability of the pharmaceutical industry to harvest wild plants for research would also have large negative consequences. Of the top 150 prescription drugs used in the United States, 118 are derived in whole or in part from plants and other natural sources. Nine of the top ten drugs are based on natural plant products. The commercial value of pharmaceuticals in the developed nations exceeds $40 billion per year.[109]

The agricultural sector also has much to lose if climate change scenarios unfold as projected and wildlife declines. One third of human food is derived from plants pollinated by wild pollinators. If birds, bats, butterflies and other natural pollinators decline due to climate change, yields of important crops would likewise decline. In the United States alone, the value to the agricultural industry of native pollinators sustained by natural habitats is estimated in the billions of dollars per year.[110]

The agricultural industry is also heavily dependent on abundant wildlife and healthy ecosystems for pest control. Roughly 99 percent of potential crop pests are controlled by natural enemies such as birds and spiders. Wildlife species save farmers billions of dollars annually by protecting crops and reducing the need for chemical control.[111]

Although the exact economic values of the natural resources threatened by climate change are difficult to calculate, there is no question that EPA's inaction on

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[108] *Id.*

[109] *Id.* at 6. Loss of wild plants would reverberate well beyond the pharmaceutical industry. Approximately 80 percent of the world's population relies on traditional medical systems, which heavily utilize extracts from wild plants. *Id.*

[110] *Id.* at 10.

[111] *Id.* at 10-11.

climate change directly affects the livelihoods and quality of life of many people.

C. Abundant Wildlife and Healthy Ecosystems Are an Essential Part of America's Heritage

What is ultimately at stake in this case is America's heritage, and whether the legacy of abundant wildlife and natural beauty that has been bequeathed to the current generation will be passed to the next. It has been said that destruction of natural habitats and the consequent loss of genetic and species diversity is the "folly our descendants are least likely to forgive us."[112] If action on climate change is taken with the urgency that it so obviously deserves, it may be the action for which our children and grandchildren are most likely to thank us.

CONCLUSION

The judgment of the Court of Appeals should be reversed.

Respectfully Submitted,

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[112] Edward O. Wilson, *Biophilia* 121 (1984).

APPENDIX

WILDLIFE CONSERVATION INTERESTS SUBMITTING AMICUS CURIAE BRIEF ON BEHALF OF PETITIONERS

Sporting and Conservation Organizations

American Whitewater
Arizona Council of Trout Unlimited
Arizona Wildlife Federation
Arkansas Wildlife Federation
Association of Northwest Steelheaders
Center for Environmental Law and Policy
Citizens Progressive Alliance
Colorado Wildlife Federation
Connecticut Forest and Park Association
Connecticut Outdoor and Environmental Education Association
Conservation Council for Hawaii
Conservation Federation of Missouri
Defenders of Wildlife
Delaware Nature Society
Environment Council of Rhode Island
Environmental League of Massachusetts
Florida Wildlife Federation
Georgia Wildlife Federation
Greenspace – The Cambria Land Trust
Idaho Rivers United
Idaho Wildlife Federation
Indiana Wildlife Federation
Iowa Wildlife Federation
Izaak Walton League
Kansas Wildlife Federation
League of Kentucky Sportsmen
League of Ohio Sportsmen
Louisiana Wildlife Federation
Miami Rod and Reel Club
Michigan United Conservation Clubs
Minnesota Conservation Federation

Montana Wildlife Federation
Mountaineers
National Audubon Society
National Wildlife Federation
Natural Heritage Land Trust
Natural Resources Council of Maine
Nebraska Wildlife Federation
Nevada Wildlife Federation
New Mexico Wildlife Federation
North Dakota Wildlife Federation
North Carolina Wildlife Federation
Oklahoma Wildlife Federation
Oregon Anglers Research Society
Oregon Council Trout Unlimited
Ornithological Society of Puerto Rico
Pacific Rivers Council
Planning and Conservation League
Polar Oceans Research Group
Prairie Rivers Network
Riveredge Nature Center and Bird Club
Riverkeepers of Fargo-Moorhead
Sandhills Rod and Gun Club
Save Our Wild Salmon
Save The River
South Carolina Wildlife Federation
South Dakota Wildlife Federation
Sustainable Obtainable Solutions
Tennessee Wildlife Federation
Texas Committee on Natural Resources
Vermont Natural Resources Council
Virgin Islands Conservation Society
Virginia Conservation Network
Washington Wildlife Federation
West Virginia Wildlife Federation
Wisconsin Wildlife Federation
Wyoming Wildlife Federation

Zoos and Aquariums

Association of Zoos and Aquariums

Religious Organizations

Earth Ministry

Wisconsin Council of Churches

Departments of State Government

California Department of Fish and Game

Washington Department of Fish and Wildlife

Professional Societies

American Fisheries Society

Ohio Chapter of American Fisheries Society

The Wildlife Society